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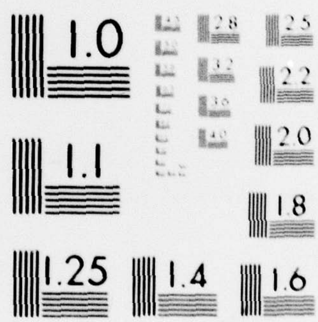

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THE QUIT RATE AS A MEASURE OF JOB AND PAY COMPARABILITY

Frank Brechling
Louis Jacobson

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The Federal government tries to keep compensation of its civilian employees competitive with compensation in the private sector by setting wages to be comparable to wages in the private sector. Reliance on wages to measure the comparability of compensation may be inferior to reliance on other measures that incorporate pecuniary and non-pecuniary factors not measured by wages alone. Theory suggests that the quit rate could be used to indicate when compensation is getting out of proper adjustment: a rise in the quit rate would indicate that total compensation is falling in

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JOB

20 comparison with compensation offered by other employers.

To judge whether the quit rate is a sensitive measure of compensation comparability, the relation of quits and relative wages in manufacturing industries was examined. Two different data sets were used to test the same general model. Both tests showed that quits rise when relative wages fall, and vice-versa. In one test, using aggregate time series data for each of twenty-six manufacturing industries, all but two industries showed this negative relationship, and the results were statistically significant in twelve of the twenty-six. The other test, using longitudinal earning records of individual workers in the steel industry and in shipbuilding produced results very close to those derived with the more aggregate data. The conclusion is that the quit rate is a sensitive measure of wage comparability. If it is to be used as a basis for adjusting federal wages, however, more must be known about hiring costs and about how quits in federal employment should be measured.

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THE QUIT RATE AS A MEASURE OF JOB AND PAY COMPARABILITY

Frank Brechling
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INTRODUCTION

At present, wages and salaries of federal government employees are determined according to the simple principle that federal workers and similar workers in private sector jobs should be paid the same hourly wage. There is growing concern that this principle is too narrowly drawn, and that, as a result, total compensation of federal workers is considerably above that in the private sector. The main problem is that many factors affecting the relative attractiveness of jobs are left entirely out of the wage setting system. Three groups of excluded factors can be distinguished.

First, there are financial benefits and other direct pecuniary rewards such as pensions, life and accident insurance, health care, annual vacations and sick leave, all of which may be regarded as part of the long-run financial compensation of employees.

Second, there are factors other than wage rates that affect earnings. These include the probability of temporary layoff, of involuntary permanent separation, and of timely promotion, all of which are likely to influence the total compensation package.

Third, there are purely non-pecuniary aspects of jobs, such as the nature of the work environment, and the physical or psychological strain of the work. These non-pecuniary aspects are very likely to be important determinants of the workers' evaluation of the job and, therefore, of the wage rate required to attract workers to federal employment. Again, none of these three types of factors is considered in the computation of "comparable" pay.

In brief, the present system of wage setting for federal employees is flawed because it equalizes only one item in the total compensation package without reference to many other relevant pecuniary and non-pecuniary factors. Consequently, the system is quite likely to lead to inappropriate total compensation.

These arguments are, of course, not novel. In fact, many changes based on such a critique already have been proposed for this wage-setting system. Some proposals would broaden the "wage" survey and the comparability principle to include non-wage factors. Such an extension would be relatively easy for the first group of factors (pensions, etc.), which are readily measured in monetary terms. But this would not be true for factors in the second and third groups. Not only is it difficult to identify and measure these factors, but workers do not all assign the same monetary value to these factors.

Although such an extension might improve the present system, relevant pecuniary and especially non-pecuniary factors concerning conditions of employment and the nature of the job are still likely to be omitted. Without accounting for all such factors, however, federal and private compensation comparability cannot be achieved.

An alternative approach to the problem would make use of the fact that workers reveal their valuations of compensation packages by their employment choices. If, on average, qualified workers prefer the package of pay, fringe benefits and working conditions of a particular job to the package offered on another, the desirable job will have a smaller proportion of quitters. Further, if job conditions change in A relative to those in B, quits are likely to adjust. Thus, quits will indicate how workers value the total compensation from a particular class of jobs.

On this basis, we expect quits in a given industry to rise as relative wages in the industry fall (and vice versa). In figure 1, curve A depicts the expected relation between relative wages and the quit rate in the federal government while curve B shows the relation in the private sector. We argue that quits are a better measure of comparability than wages because relevant factors other than wages affect quits as well. At the same relative wage, w, the private sector quit rate (q_B) is higher than the federal quit rate (q_A) because unmeasured pecuniary and nonpecuniary aspects of work are lower in value. The compensation packages would be equal only if relative wages were set at w* in the federal sector while wages were at $\bar{w}$ in the private sector.

At those relative wage rates, the quit rates in federal and private employment would be equal at q_B.

Before arguing that quit rates should actually be used to set wages, however, we should demonstrate that the negative relation between relative wages and the quit rate exists, can be measured, and is stable. This is the purpose of this report.

METHODOLOGY

Many economists have studied the determinants of quit rates -- using quit rates collected by the Bureau of Labor Statistics (BLS) for manufacturing industries. Most analysts have examined differences across industries and found that industries with higher wages <u>ceteris paribus</u> have lower quit rates. This evidence, however, does not necessarily mean that, within a given industry, changes in wages relative to wages in other industries will cause quits to change as well. At least part of the wage differential probably represents the hiring of workers with inherently different attributes. One such attribute could be a different quit propensity.

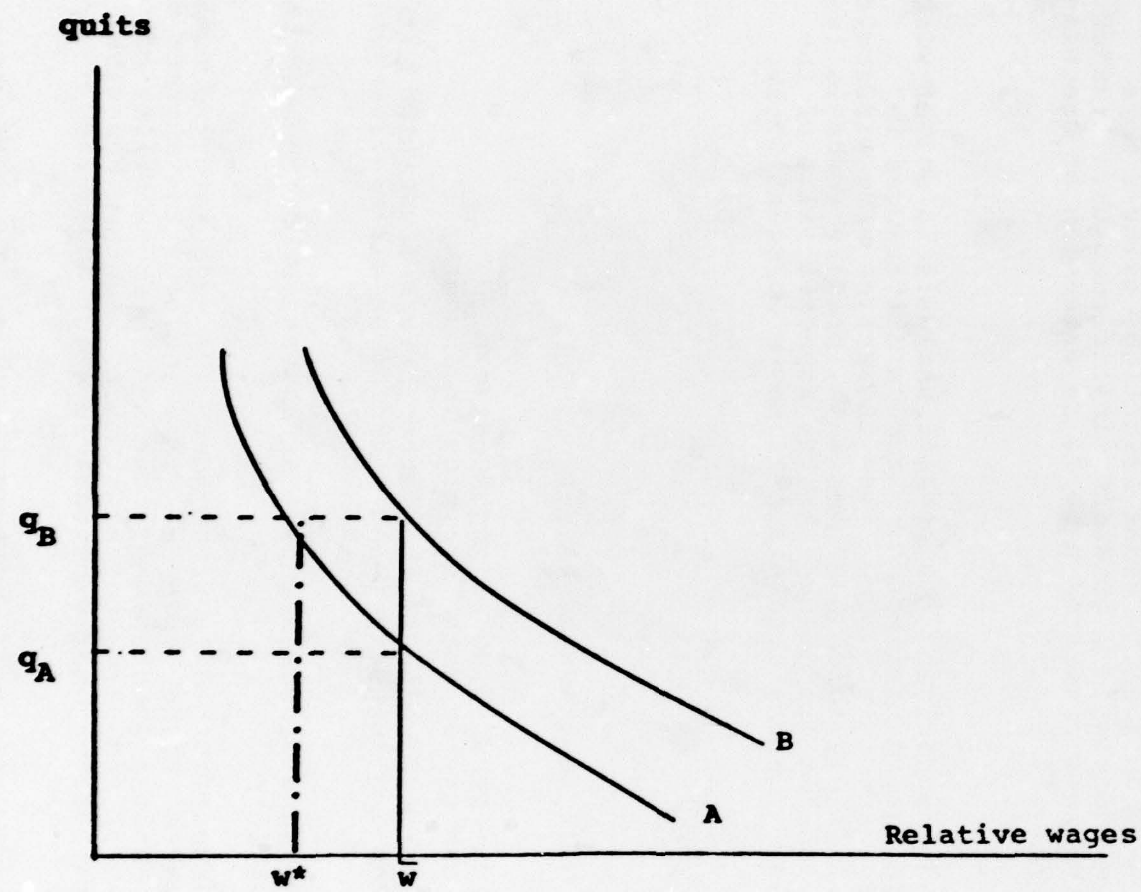

Figure 1: The relation between the quit rate and relative wages in the public and private sectors

The best evidence concerning the effect of wages on quit rates would be from time series studies of individual industries. Although there are quite a few such time series studies, most exclude changes in relative wages as a determinant of variation in quits. Instead they focus on cyclical factors such as the unemployment rate. There are two exceptions. Douglas Adie explicitly examined the relation of wages and quit rates in a number of manufacturing industries and found a strong negative association between them.* Frank Brechling, using a more comprehensive formulation, obtained similar results. A major portion of the work presented here is an extension of Brechling's earlier analysis.**

The Model

The basic model underlying the present analysis is one of workers' utility (earnings) maximization. Because differences in non-pecuniary aspects of work across industries are difficult to measure and unlikely to change over time, primary emphasis is placed on measuring differences in the expected value of the income stream. The basic relation is shown in equation 1.

(1) $q = f(y_i/y_m)$

where

q_i = quit rate in industry i

y_i = expected value of income stream associated with remaining in industry i

y_m = expected value of the income stream associated with leaving industry i and entering an alternative job.

The expected value of one's income stream can be decomposed into a number of elements.

One element describes the current job: the wage rate and number of hours expected to be employed. This includes the current wage level, expectations about promotions, and the possibility of temporary layoff and permanent separation. Another describes possible alternative jobs: expectations about wages and

*Douglas K. Adie, "An Evaluation of Postal Service Wage Rates," American Enterprise Institute, Washington, D.C., 1977.
**Frank Brechling, "A Time Series Analysis of Labor Turnover," in The Impact of International Trade and Investment on Employment, U.S. Department of Labor, Washington, D.C., 1978.

hours and the potential for finding a new job. Equation 2 represents the decomposition.

$$(2) \quad \frac{y_i}{y_m} = g(E(w_i), E(h_i), E(w_m), E(h_m), P(j_m))$$

where

$E(w_i)$ = expected wages in industry i

$E(h_i)$ = expected hours in industry i

$E(w_i)$ = expected wages given one leaves industry i and finds employment

$E(h_m)$ = expected hours given one leaves industry i and finds employment

$P(j_m)$ = probability of finding alternative employment

Empirically, expected wages are measured with variables such as current wage rates and trends in wages; expected hours are measured with variables describing employment trends, layoff patterns, and recent trends in layoffs; the probability of finding a job is measured by variables which include unemployment rates and changes in output.

The basic model described in equation 2 was estimated using two radically different data sets. The first data set was aggregate quarterly data for each of 26 manufacturing industries 1955-76. The data were available in published form from Employment and Earnings and Survey of Current Business.

The second data set combined published data and individual work histories derived from Social Security is Longitudinal Employer-Employee Data (LEED) file. These data were used to examine quits in the period 1962-70 in the steel and shipbuilding industries.

Estimation with Aggregate Data

For the aggregate time series analysis of the determinants of voluntary quits, the following estimating equation was used:

$$(3) \quad Q = \alpha_0 + \alpha_1 w + \alpha_2 \Delta N + \alpha_3 N + \alpha_4 U + \alpha_5 \Delta\overline{N} + \alpha_6 \Delta E + \alpha_7 D_2 + \alpha_8 D_3 + \alpha_9 D_4$$

where

Q = absolute number* of quarterly voluntary quits

$\overline{w}$ = ratio of wages in the industry to those in all other industries (w_i/w)

ΔN = current employment change in the industry

N = employment stock in the industry

U = unemployment rate for the U.S. economy

$\Delta\overline{N}$ = employment change over 3 to 8 past quarters in the industry

ΔE = employment change in all other industries

D_2, D_3, D_4 = seasonal dummy variables.

Initial OLS estimates of equation (3) indicated that there was considerable auto-correlation in the residuals so the regressions were rerun with the Hildreth-Lu adjustment for auto-correlation.

Detailed results are presented in Appendix A. For present purposes, the influence of relative wages (measured by $\overline{w}$) is of particular interest. For ease of interpretation, the elasticities of relevant regression variables are shown in table 1.

These elasticities suggest strongly that there exists a significant and quite sizeable negative relationship between relative wages and voluntary quits in manufacturing industries. The high values of the elasticities suggest that quits are a particularly sensitive measure of changes in relative wages. While the above results are interesting and encouraging, they also suggest significant inter-industry differences in the relation between relative wages and voluntary quits.

Estimation With Individual Data

The aggregate analysis shows that quit behavior and relative wages are clearly related. When using aggregate data to measure quits, however, unmeasured changes in characteristics of the work force in an industry may be correlated with wage changes and the changes

*Although the dependent variable is quits rather than the quit rate, the presence of N as an independent variable in the equation makes it possible to calculate the dependence of the quit rate on relative wages.

in individual characteristics may cause changes in quits. If so, the effect of wages on quitting will appear stronger (or weaker) than it actually is. To check the validity of the aggregate findings, quits were also analyzed using data on individuals. The major advantage of individual level data is that the effects of wage differences on quits can be distinguished from the effect of such worker characteristics as tenure. Another virtue is that data describing each worker's local labor market provide a more precise measure of alternative opportunities than do average conditions for the nation as a whole.

TABLE 1
ELASTICITIES OF QUITS WITH RESPECT TO
RELATIVE WAGE BY INDUSTRY

Industry	Elasticity+
Durables	-1.90
Stone, Clay and Glass Products	-5.39*
Primary Metals	-4.31*
Blast Furnaces and Steel Mills	-6.26*
Fabricated Metal Products	-2.66
Machinery, except Electrical	- .50
All Machinery	- .98
Electrical Machinery	-6.70*
Radio and TV Receiving Equipment	- .06
Communication Equipment	- .07
Transportation Equipment	-1.52
Motor Vehicles and Parts	-2.28
Aircrafts and Parts	-1.15
Engineering and Scientific Istruments	-2.64*
Non-Durables	.63
Food and Kindred Products	-3.72
Meat Products	-5.53*
Tobacco Products	-1.12
Textile Mill Products	-2.40*
Weaving Mills, Cotton	- .33
Paper and Allied Products	-4.35
Paper and Pulp Mills	5.82*
Chemicals and Allied Products	-6.51*
Petroleum and Coal Products	-4.60*
Rubber and Plastics Products	-5.90*
Footwear, except Rubber	-3.77*

*The underlying regression coefficient is significant at the 5 percent level or smaller.

+These elasticities measure the percentage change in the number of quits given a 1% change in mean relative wages.

One disadvantage in the disaggregated data used is that while the data show whether or not a worker leaves a given employer, they do not reveal the reason for leaving. An indirect procedure for distinguishing voluntary separations (which we count as quits) from involuntary separations (layoffs, dismissals for misconduct, etc.) was therefore used.

Because the data set used is unusual, it is worth describing in some detail. The LEED data is a 1% random sample of work histories of employment covered by Social Security taxes. For each worker in the sample, the worker's age, race, and sex is reported, as is quarterly earnings, location, and industry for each employer 1957-72. Because the worker's records are longitudinal, we can measure tenure by counting prior quarters of industry or firm-specific experience and then track earning trends over time.

To study quits in the steel (SIC 3312) and shipbuilding (SIC 373) industries, workers with any employer reports from SIC 3312 or 373 were extracted from the total file. The full file contains records of more than 1.4 million workers. The steel and shipbuilding files contain records of 24,000 and 14,000 workers respectively. To examine the effect of relative wages on quitting, we further limited the sample to workers in those standard metropolitan statistical areas (SMSAs) for which labor market information is published. This reduced the actual samples used here by about 50% in each case. Data on employment and turnover in each worker's plant (or industry in a given SMSA) were derived from tabulations of the LEED samples.

These tabulations were used to measure expected changes in hours and, even more importantly, to distinguish voluntary from involuntary separations. Permanent separations are unlikely to occur when employment in a given firm is either stable or growing. Where employment was falling, some separations were probably layoffs rather than quits. Thus, workers were omitted from the quit equation if employment in their own firm was declining.*

The quit equation used for the steel industry analysis is shown as equation 4 below. The equation used for the shipbuilding analysis is very similar. The equation was estimated using ordinary least squares regression. Although it would be appropriate to use logit analysis here, the dependent variable was instead transformed using a discriminant function, which produces results approximately the same as those from a logit analysis. Table 2

*The quit equation was also run on workers in firms where employment was declining in order to determine if the coefficients differed and were more typical of involuntary separations. This was found to be the case.

TABLE 2

QUIT ELASTICITIES

	Variable	Elasticity
1.	Earnings in manufacturing (QEYM1)	3.47
2.	Worker's own earnings (ERNYM1)	-1.29
3.	Race	-1.13
4.	Relative unemployment (CYCM1)	.65
5.	Employment stability in own job (LQIM1)	-.24
6.	Labor force in local area (LFORCE)	.18
7.	Percent of local employment in steel (PCTSTL)	-.13
8.	Worker's tenure	-.11

gives the main results for the steel industry. All elasticities in the table have the expected sign and are statistically significant at the 5% level. Only variables with elasticities greater than .1 are displayed.

$$
\begin{aligned}
(4)\quad Q = {} & a_0 + b_1\mathrm{Age} + b_2\mathrm{Race} + b_3\mathrm{Tenure} + b_4\mathrm{ERNYM1} + b_5\mathrm{ERNYM2} \\
& + b_6\mathrm{LQIM1} + b_7\mathrm{LQIM2} + c_1\mathrm{EMPY} + c_2\mathrm{TURYM1} \\
& + d_1\mathrm{PCTSTL} + d_2\mathrm{LFORCE} + d_3\mathrm{CITSIZ} \\
& + d_4\mathrm{QEY} + d_5\mathrm{QEYM1} + d_6\mathrm{CYCY} + d_7\mathrm{CYCM1}
\end{aligned}
$$

where

Dependent Variable:

Q = separates = 1, does not separate = 0

B. Variables Describing the Worker:

1.	Age	(years)
2.	Race	0 = unknown 1 = white 2 = non-white
3.	Tenure	years of steel employment since 1956
4.	ERNYM1	worker's average quarterly earnings in year before quitting
5.	ERNYM2	worker's average quarterly earnings two years before quitting
6.	LQIM1	low quarter intensity year before quitting (measures steadiness of employment)
7.	LQIM2	low quarter intensity two years before quitting

C. Variables Describing the Worker's Firm

8.	EMPY	employment year of quitting (100's)
9.	TURYM1	turnover year before quitting (100's)

D. Variables Describing the Worker's Local Labor Market

10.	PCTSTL	(percent steel) fraction of total SMSA employment in steel industry (% x 10)
11.	LFORCE	labor force (100's)
12.	CITSIZ	change in city population 1955-62 (%)
13.	QEY	average quarterly earnings year before quitting ($ x 10)
14.	QEYM1	average quarterly earnings year before quitting ($ x 10)

*These results are more fully discussed in appendix B which displays the results for shipbuilding as well.

15. CYCY (cycle placer variable) city's unemployment in 1962 (UE62) divided by unemployment in year of quitting (UEY) (%x10)
16. CYCM1 cycle placer year before quitting

The key finding is that quits in the steel industry are quite sensitive to a change in earnings in manufacturing (the elasticity is 3.47).

CONCLUSIONS

The major finding of this study is a strong, consistent, negative association between quit rates and relative wage rates. This emerges both from the aggregate analysis and from the analysis, using individual data, in which factors such as age, tenure, and local labor market conditions were included. The fact that, in the aggregate analysis, this negative association was found in twenty-four out of twenty-six industries, and was statistically significant in twelve of them, is an unusually consistent and robust result. That the alternative procedure for measuring the quit-wage rate relation achieved similar results greatly enhances confidence in the findings.

These results suggest that the relation depicted in figure 1 exists, is stable, and can be measured. More important, they strongly support the basic hypothesis that quit rates can be used to depict the way workers assess the net compensation offered in a given job. Although quits react most strongly to changes in relative wages, a host of other factors were shown to affect quits as well. In the disaggregate analysis, almost every factor, such as the local unemployment rate and employment stability in the worker's firm, exhibited the expected relation and was statistically significant. Most of these other factors are important indications of the relative value of a given job. While they are unmeasured by the wage survey, they would be captured if quit rates were used to assess compensation comparability.

These results strongly support the <u>principle</u> that quit rates can play a valuable role in measuring the comparability of total compensation in federal and private employment. More information is needed, however, before the principle can be applied. The calculation of wage comparability is made, not for an industry, but for selected occupations and experience levels. Data on labor turnover by occupation and experience in the private labor market would have to be collected, and the same type of consistent results demonstrated. In addition, complementary data on federal quits would be needed. While it may be relatively simple to collect the requisite data, its use is not simple. For example,

federal quit levels are known to be extraordinarily low. This may indicate that the compensation package is relatively generous. On the other hand, the huge size of the federal establishment and ease of intra-government transfer enable a worker dissatisfied with promotion possibilities or working conditions on his particular job to find a new job without leaving the federal system. Thus, quits (separation out of the federal system) may not be comparable to quits in the private sector. A quit rate which includes intra-government transfers may allow a more appropriate comparison.

Even if comparable quit and wage rate data can be developed, the critical issue remains precisely how these data should be used. Wages could be set so that federal and private quits would be equal. Such a system would equalize compensation for public and private workers and, from an equity standpoint, the compensation would be fair. The problem is that the system may be inefficient.*

The optimal quit-wage rate combination is one that minimizes labor costs. In calculating labor costs one must include not only direct wage costs but indirect costs as well, such as health and pension benefits, hiring and training costs. These costs are balanced against the worker's productivity. If hiring costs are especially high, training is very specific and expensive, or if productivity increases greatly with experience, turnover (quitting) is very costly to the firm. A firm may choose to pay a premium to reduce these costs. The costs of turnover may be different in the federal government from those in private industry. If they are, the federal system might be made more efficient by using the same cost minimizing decision rule used by the private sector, rather than by setting wages to equalize quit rates.

---

*Economists find that efficient solutions are generally equitable. As long as workers are free to enter and leave a specific job they cannot be considered to be working against their will. Thus they are deemed to view their compensation as equitable. If equity is defined in terms other than the wage it would take to induce people to work, however, the resulting compensation would be inefficient.

APPENDIX A

APPENDIX A

The following table contains the relevant regression coefficients of equation (3). The symbols are as follows:

RHO:	Auto-correlation coefficient of residuals
$\overline{w}$:	Wage rate within the industry divided by mean wage rate of all <u>other</u> manufacturing industries
ΔN:	Current change in employment
N:	Stock of employment at the beginning of the period
U:	National unemployment rate
$\Delta \overline{N}$:	Employment change over the past several quarters*
E	Employment change over past several quarters in rest of the economy*
	or
	Employment change over past several quarters in rest of manufacturing*

*Various numbers of quarters were tried and the best fit was chosen.

RHO TRANSFORM RESULTS

Index Code	RHO	$\bar{w}$	ΔN	N	u	$\Delta \bar{N}$	ΔE	INDUSTRY
100	.99	-863.946	.2497	.3001	77.079	.03232	.1695	Durables
	(61.98)	(1.02)	(6.66)	(6.49)	(5.05)	(1.20)	(2.69)	
110	.54	-190.136	.2072	.3876	-2.6324	-.08123	-.003167	Stone, Clay
	(5.67)	(1.96)	(3.13)	(8.96)	(2.52)	(.234)	(3.01)	& Glass
120	.31	-139.054	.1165	.1791	1.466	-.00344	.00421	Primary Results
	(2.88)	(3.81)	(7.62)	(8.02)	(.91)	(.26)	(3.02)	
121	.34	-45.360	.0461	.0808	1.315	-.02124	.00241	Blast Furnaces and
	(3.19)	(2.91)	(4.21)	(4.23)	(1.22)	(2.69)	(2.81)	Steel Mills
130	1.00	-189.188	.3032	.4196	8.3288	.01292	-.00208	Fabricated Metal
		(.81)	(5.15)	(5.32)	(2.51)	(.35)	(1.21)	Products
140	.37	-31.110	.1685	.0704	-10.9601	.01801	-.00616	Machinery except
	(3.52)	(1.35)	(3.77)	(10.88)	(8.53)	(1.72)	(3.73)	Electrical
141	.46	-138.763	.1476	.0807	-20.6456	.04255	-.01699	All Machinery
	(4.58)	(1.90)	(3.61)	(10.70)	(7.78)	(2.95)	(5.51)	
150	.98	-565.485	.1708	.2231	.8903	-.00380	-.00324	Electrical
	(43.49)	(2.95)	(5.76)	(5.039)	(.33)	(.17)	(2.08)	Machinery
151	.72	-.556	.1162	.1531	-.6961	.01646	-.00061	Radio and TV
	(9.16)	(.09)	(5.56)	(6.90)	(2.51)	(1.63)	(3.17)	Receiving Equip.
152	.51	-.988	.0704	.0586	-1.8165	.01443	-.00070	Communication
	(5.24	(.04)	(2.23)	(6.67)	(6.05)	(3.96)	(2.59)	Equipment
160	.57	-83.443	.1190	.1280	.1205	.02445	-.00349	Transportation
	(6.13)	(1.12)	(8.79)	(10.09)	(.07)	(2.37)	(2.62)	Equipment
161	.54	-40.585	.0581	.0976	-2.0337	-.02468	.00251	Motor Vehicles and
	(5.67)	(1.56)	(5.93)	(6.91)	(2.33)	(3.03)	(3.51)	Parts
162	.44	-18.337	.0760	.0711	.1996	.08583	.00092	Aircrafts and
	(4.33)	(.71)	(3.33)	(10.64)	(.36)	(3.89)	(2.12)	Parts
171	.44	-5.86	.0660	.0640	-.2513	.00449	-.00015	Engineering and
	(4.33)	(5.09)	(1.79)	(4.94)	(3.73)	(1.20	(2.26)	Scientific Instruments
200	.53	392.041	-.0083	.3618	-11.3827	-.04012	.04680	Non-Durables
	(5.52)	(.36)	(.11)	(12.15)	(1.35)	(.58)	(2.74)	
210	.96	-567.891	-.4331	-1.0238	-3.0500	.39561	.01596	Food and Kindred
	(30.28)	(1.54)	(3.23)	(5.21)	(3.83)	(3.83)	(3.06)	Products
211	.68	-167.956	.1660	.4761	-1.8119	.03378	.00144	Meat Products
	(8.19)	(2.60)	(1.49)	(4.52)	(2.00)	(2.25)	(1.73)	
220	.41	-4.899	.0181	-.1231	-.7747	.10375	-.38030	Tobacco Products
	(3.97)	(1.45)	(.71)	(3.85)	(7.22)	(4.05)	(3.23)	
230	.93	-285.018	.4198	.8075	5.6499	-.09635	-.00249	Textile Mill
	(22.25)	(2.25)	(5.18)	(7.98)	(2.27)	(1.88)	(1.55)	Products
231	.98	-9.060	.2745	.4451	.4263	.00491	.00085	Weaving Mills,
	(43.49)	(.85)	(2.98)	(4.45)	(.64)	(.67)	(1.94)	Cotton
240	.67	-139.759	.0762	.2471	-3.3599	.00394	.00217	Paper and Allied
	(7.97)	(1.38)	(.86)	(5.39)	(2.80)	(.10)	(2.68)	Products
241	.41	31.5670	-.1064	.0605	-1.6198	.36335	.00051	Paper and Pulp
	(3.97)	(4.08)	(2.08)	(1.50)	(5.40)	(.89)	(2.13)	Mills
250	.17	-167.954	.09086	.06316	-3.4173	.06841	-.00316	Chemicals and
	(1.52)	(3.98)	(1.66)	(13.08)	(6.33)	(2.83)	(3.94)	Allied Products
260	.52	-16.578	.0369	-.0059	.0194	.07876	.00039	Petroleum and
	(5.38)	(2.41)	(1.86)	(.29)	(.10)	(4.74)	(2.18)	Coal Products
270	1.00	-227.057	.2014	.2844	2.0249	.06816	-.00123	Rubber and Plas-
		(4.25)	(5.99)	(4.24)	(1.37)	(1.91)	(1.72)	tic Products
281	.99	-115.668	.4059	.5193	-.3877	-.01283	-.00085	Footwear, except
	(61.98)	(2.50)	(4.70)	(4.17)	(.52)	(.16)	(2.23)	Rubber

APPENDIX B

Table B-1 describes the characteristics of the LEED data used to analyze quits in the steel industry. There were 12,117 observations in the steel data set. The variables are defined in the main text.

Table B2 presents the full estimated equation for the steel industry as described by equation 4 in the main text.

Table B3 describes the characteristics of the data used to analyze quits in the shipbuilding industry. There are 8,568 observations on the shipyard workers.

Table B4 presents Ordinary Least Squares estimates (OLS) of the equation 4 for shipbuilding workers. Several variables included in the analysis of the steel industry were unavailable for shipbuilding workers. Computer conversion problems prevented our obtaining discriminant estimates for shipbuilding. These coefficients and elasticities are not directly comparable to those for steel. The discriminant estimates generally are not very different, however. In particular, the relative importance of the variables and significance of the coefficient changes vary little.

A few general observations can therefore be made with reasonable confidence. It is apparent that earnings in manufacturing is still the variable with highest elasticity, although it is considerably lower than for steel. Tenure for shipbuilding workers is an extremely important determinant of quitting, with a far higher elasticity than for steel workers. An interesting difference between steel and shipbuilding is that shipbuilding workers are more affected by local labor market conditions in the year in which they leave than by conditions in the prior year, while the reverse is true for steel workers. This may indicate that shipyard workers quit and find jobs relatively quickly while steel workers decide to search for work and then take a considerable time to find a suitable job.

APPENDIX B

TABLE B-1

CHARACTERISTICS OF STEEL WORKER FILE

STATISTICS ON FINAL DATA

	VARIABLE	MEAN	VARIANCE	MAXIMUM	MINIMUM
1	AGE	41.5167	12.0941	72.00	18.0
2	RACE	1.09231	1.2523	2.0	1.0
3	TENURE	6.03170	7.3667	13.0000	0.0
4	ERNY	1740.89	816.383	7479.00	0.0
5	ERNYM1	1615.10	836.421	7500.00	0.0
6	ERNYM2	1473.74	872.583	7750.00	0.0
7	LOIY	77.6603	73.6906	999.000	0.0
8	LOIM1	76.0177	74.4335	999.000	0.0
9	LOIM2	71.6033	76.1906	999.000	0.0
10	EMPY	138.000	159.416	531.000	0.0
11	EMPYM1	126.953	145.905	505.000	0.0
12	EMPYP1	136.180	159.309	531.000	0.0
13	TURY	6.32525	10.9314	200.000	-11.0000
14	TURYM1	1.09466	15.7749	100.000	-200.000
15	TURYP1	-2.32962	16.9229	100.000	-185.000
16	PCTSTL	74.6137	64.3912	190.000	1.00000
17	LFORCE	8022.68	7308.52	24947.0	490.000
18	CITSIZ	1.02476	9.12824	38.0000	-0.00000
19	UEY	39.5765	12.1251	95.0000	15.0000
20	UEYM1	45.1233	17.7633	94.0000	16.0000
21	UEYP1	37.8861	10.9965	95.0000	15.0000
22	CYCY	173.961	62.0154	351.000	88.0000
23	CYCM1	159.738	69.9016	351.000	78.0000
24	CYCP1	181.392	64.5341	351.000	77.0000
25	GEY	14977.2	1672.41	20460.0	10373.0
26	GEYM1	14750.6	1305.23	20460.0	10246.0
27	GEYP1	15029.8	1438.20	20460.0	10493.0
28	YD2	0.111496	0.314759	1.0	0.0
29	YD3	0.225633	0.418016	1.0	0.0
30	YD4	0.188000	0.390729	1.0	0.0
31	YD5	0.803829D-01	0.271896	1.0	0.0
32	YD6	0.922671D-01	0.289415	1.0	0.0
33	YD7	0.560623D-01	0.231569	1.0	0.0
34	YD8	0.126599	0.332532	1.0	0.0
35	YD9	0.118759	0.323518	1.0	0.0
36	SEPDUM	0.124341	0.329641	1.0	0.0

DATA MATRIX(36,12117)

The definition of all the variables are found on pages 10 and 11 except for the following:

YDi (where i = 1961 + i) =
1 if individual is in the steel industry
0 if not

TABLE B-2

DISCRIMINANT REGRESSION ON SEPARATION DUMMY FOR STEEL WORKERS

DISCRIMINANT ESTIMATION OF SEPDUM

VARIABLE	COEFFICIENT (STANDARD ERROR)	T STATISTIC	ADDITION TO RSQ (PARTIAL-R)	ELASTICITY (BETA)
AGE	-0.414060-02 (0.302300-02)	-1.3697	0.132110-03 (-0.124510-01)	-0.15058 (-0.309730-01)
RACE	-0.64990 (0.516330-01)	-12.586	0.111550-01 (-0.11368)	-1.1269 (-9.7523)
TENURE	-0.10723 (0.842300-02)	-12.730	0.114120-01 (-0.11496)	-0.11035 (-9.7672)
EANYM1	-0.914420-03 (0.754050-04)	-12.127	0.103560-01 (-0.10458)	-1.2930 (-0.25813)
EANYM2	-0.101430-03 (0.765810-04)	-1.3245	0.123540-03 (-0.120400-01)	-0.13094 (-0.291740-01)
LOIM1	-0.353470-02 (0.624720-03)	-5.6583	0.225460-02 (-0.513710-01)	-0.23538 (-0.867270-01)
LOIM2	0.179490-03 (0.618840-03)	0.29005	0.592410-05 (0.263680-02)	0.112900-01 (0.450770-02)
EMPY	-0.448210-03 (0.200710-03)	-2.2332	0.351180-03 (-0.202970-01)	-0.541800-01 (-0.235510-01)
TURYM1	0.200990-02 (0.193910-02)	1.0365	0.756540-04 (0.942240-02)	0.192730-02 (0.104510-01)
PCTSTL	-0.197110-02 (0.770520-03)	-2.5582	0.460830-03 (-0.232500-01)	-0.12883 (-0.418350-01)
LFORCE	0.238760-04 (0.504130-05)	4.7361	0.157950-02 (0.430150-01)	0.18452 (0.575170-01)
CITSIZ	0.313100-01 (0.431570-02)	7.2532	0.370460-02 (0.657950-01)	0.281050-01 (0.942060-01)
CYCY	-0.214350-03 (0.942700-03)	-0.22738	0.364070-05 (-0.206710-02)	-0.326530-01 (-0.443810-02)
CYCM1	0.461930-02 (0.756240-03)	6.1083	0.262740-02 (0.554450-01)	0.64636 (0.10643)
OEY	0.471630-04 (0.209250-04)	2.2539	0.357730-03 (0.204860-01)	0.61875 (0.259990-01)
OEYM1	0.268800-03 (0.294250-04)	9.1349	0.587610-02 (0.827590-01)	3.4731 (0.11554)
CONS	-4.4976 (0.41534)	-10.829	0.0 (0.0)	0.0 (0.0)

TABLE B-3

CHARACTERISTICS OF SHIPBUILDING WORKER FILE

VARIABLE		MEAN	STANDARD DEVIATION	VARIANCE	(STD. DEV.)/MEAN
AGE	1	39.1229	13.6689	186.844	0.349376
RACE	2	1.14996	0.406860	0.165535	0.353806
TENURE	3	3.74863	3.95299	15.6261	1.05452
EARN	4	1135.72	867.226	752081.	0.763594
EARNM1	5	1027.16	833.476	694682.	0.811441
EARNM2	6	934.599	813.161	661231.	0.870069
EMPY	7	62.1724	52.3632	2741.91	0.842226
EMPYM1	8	58.0622	51.0087	2601.88	0.878517
EMPYP1	9	63.1118	53.0702	2816.45	0.840903
TURY	10	3.52351	6.37299	40.6150	1.80870
TURYM1	11	3.08612	6.51321	42.4219	2.11048
TURYP1	12	-1.54565	9.79327	95.9081	-6.33602
UEY	13	38.4092	11.4550	131.217	0.298243
UEYM1	14	41.0932	13.4377	180.572	0.327006
UEYP1	15	36.5658	16.8136	282.696	0.459806
CYCY	16	143.968	39.9876	1599.01	0.277753
CYCYM1	17	135.396	41.1485	1693.15	0.303914
CYCYP1	18	358.519	1784.17	.318327E+07	4.97651
GEY	19	15040.7	2261.95	.511642E+07	0.150388
GEYM1	20	14456.3	2183.35	.476700E+07	0.151031
GEYP1	21	15335.9	3103.11	.962929E+07	0.202343
DUM1	22	0.752713	0.431460	0.186158	0.573206
DUM2	23	0.247287	0.431460	0.186158	1.74478
CONS	24	1.00000	0.	0.	0.

TABLE B-4

OLS REGRESSION ON SEPARATION DUMMY VARIABLE FOR SHIPBUILDING WORKERS

		SOURCE	DF	SS	MS	F
MULTIPLE R	0.36995	DUE REGRESSION	9	218.29	24.255	150.79
STD ERROR OF Y.X	0.40106	DEV. FROM REG.	8559	1376.7	0.16085	
R SQUARE	0.13686	TOTAL	8568	1595.0	0.18616	

MULTIPLE REGRESSION EQUATION

VARIABLE		COEFFICIENT	STD. ERROR	T VALUE	PARTIAL COR.	ELASTICITY
DUM2	*					
CONST.		0.3083	.4185E-01	7.366		
AGE	X- 1	-.22715E-03	.41076E-03	-0.5529	-.6029E-02	-.3594E-01
RACE	X- 2	-.60862E-02	.13288E-01	-0.4580	-.4946E-02	-.2829E-01
TENURE	X- 3	-.31395E-01	.15038E-02	-21.29	-0.2242	-0.4849
EARNM1	X- 5	-.33578E-04	.11478E-04	-2.925	-.3156E-01	-0.1395
EARNM2	X- 6	-.14900E-05	.12315E-04	-0.1210	-.1309E-02	-.5631E-02
EMPY	X- 7	-.44245E-03	.93932E-04	-4.710	-.5085E-01	-0.1112
TURY	X-10	-.49513E-02	.69261E-03	-7.149	-.7703E-01	-.7055E-01
CYCY	X-16	.16226E-03	.11059E-03	1.467	.1580E-01	.9444E-01
GEY	X-19	.88035E-05	.21040E-05	4.184	.4518E-01	0.5354